5.6-10.5 GHz Up-Converter QFN, 4x4mm

February 2010 - Rev 18-Feb-10

XU1012-QH
XRoHS

Features

- Optimized for LSB Operation
- 8 dB Conversion Gain
- 25 dBm OIP3
- 25 dBc LO Suppression Typical
- 15 dB Linear Gain Control
- 4x4mm QFN Package

General Description

Mimix Broadband's 5.6-10.5 GHz GaAs MMIC integrated up-converter has a typical LSB conversion gain of 8 dB, and an image rejection of 15 dBc. The device includes an LO Buffer amplifier, double balanced image reject mixer, RF buffer amplifier and variable attenuator. Variable gain regulation can be achieved through bias adjustment with turn-down trajectories optimized to maintain linearity and minimal LO leakage. The device comes in a an RoHS compliant 4x4mm QFN surface mount package offering excellent RF and thermal properties. Typical applications for this device are as an up-converter stage in linear C-Band radio transmit lineups. The device is well suited for Millimeter-wave Point-to-Point Radio, LMDS, SATCOM and VSAT applications.

Absolute Maximum Ratings[1]

Supply Voltage (Vd)	+7V
Gate Bias Voltage (Vg)	-3.0<Vg<0V
Supply Current (LO Buffer)	150 mA
Supply Current (RF Buffer)	150 mA
IF Input Power (IFin)	+15 dBm
LO Input Power (LOin)	+15 dBm
Storage Temperature (Tstg)	-65 to +165 °C
Operating Temperature (Ta)	-40 to +85 °C
Abs. Max. Junction/Channel Temp.	150 °C
Continuous Power Dissipation (Pdiss) at 80 °C	1.5W
Thermal Resistance (Tchannel=150 °C)	50 °C/W
Mouting Temperature	See solder reflow profile
ESD Min. - Machine Model (MM)	Class A
ESD Min. - Human Body Model (HBM)	Class 1A
MSL Level	3

(1) Operation of this device above any one of these parameters may cause permanent damage.
(2) Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.

Bias Requirements

Parameter	Units	Min.	Typ.	Max.
Drain Bias Voltage LO Buffer (Vd1)	VDC		+5.0	
Drain Bias Voltage RF Amp Stage 1 (Vd2)	VDC		+5.0	
Drain Bias Voltage RF Amp Stage 2,3 (Vd3)	VDC		+5.0	
Gate Bias Voltage LO Buffer (Vg1)	VDC		-1.0	
Gate Bias Voltage RF Amp Stage 1 (Vg2)	VDC		-1.0	
Gate Bias Voltage RF Amp Stage 2,3 (Vg3)	VDC		-1.0	
Variable Attenuator Control (Vc)	VDC	-2.5	-	0.0
Supply Current LO Buffer (Id1)	mA		80	
Supply Current RF Amp Stage 1 (Id2)	mA		60	
Supply Current RF Amp Stage 2,3 (Id3)	mA		20	

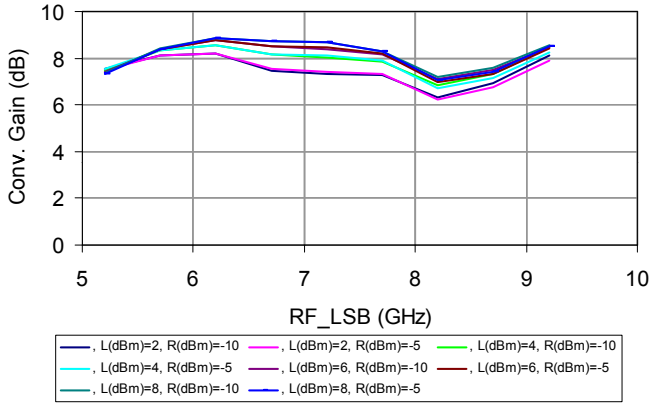
Mimix Broadband, Inc., 10795 Rockley Rd., Houston, Texas 77099
Tel: 281.988.4600 Fax: 281.988.4615 mimixbroadband.com

Electrical Characteristics

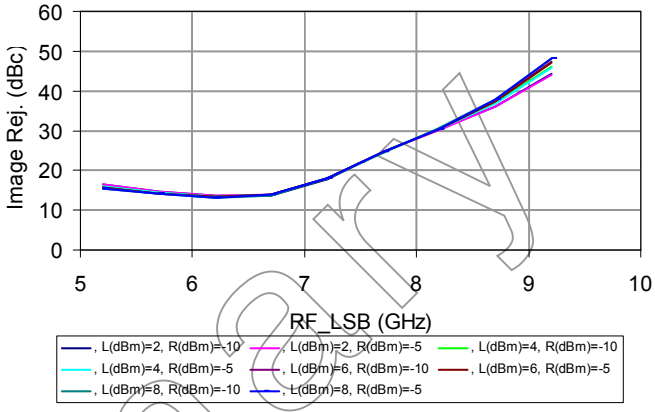
Parameter	Units	Min.	Typ.	Max.
Frequency Range (RF)	GHz	5.6	-	10.5
Frequency Range (LO)	GHz	7.5	-	12.0
Frequency Range (IF)	dB	DC	1.8	2.5
LO Input Power (PLO)	dBm	3.0	-	9.0
Conversion Gain	dB		8.0	
Image Rejection	dBc		15.0	
Input IP3 (IIP3) at Maximum Gain	dBm		19.0	
Output IP3 (OIP3) at Maximum Gain	dBm		25.0	
LO Leakage at RF with 4 dBm Input Power	dBm		-28.0	-21.0
RF Return Loss	dB		10.0	
LO Return Loss	dB		10.0	
IF Return Loss	dB		14.0	
Gain Variation	dB		15	

Measured Performance

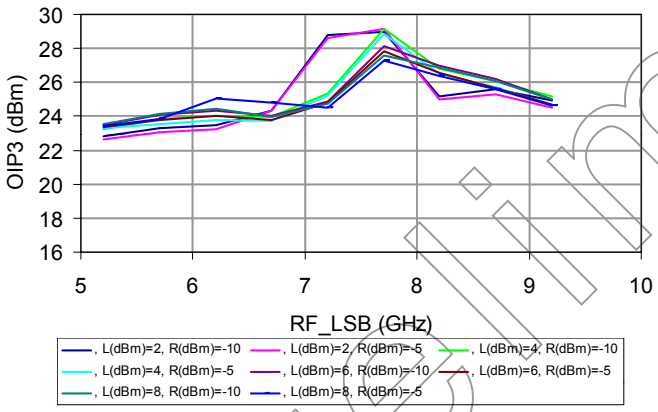
XU1012-QH: Conv. Gain (dB) vs. RF_LSB (GHz)
IF=1.8GHz, -10dBm, -5dBm, LO=2-8dBm



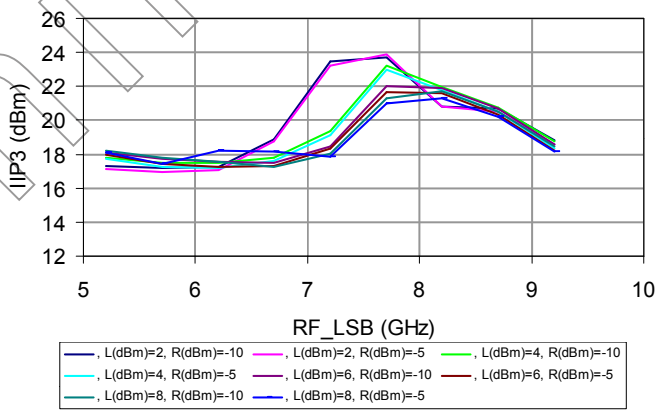
XU1012-QH: Image Rej. (dBc) vs. RF_LSB (GHz)
IF=1.8GHz, -10dBm, -5dBm, LO=2-8dBm



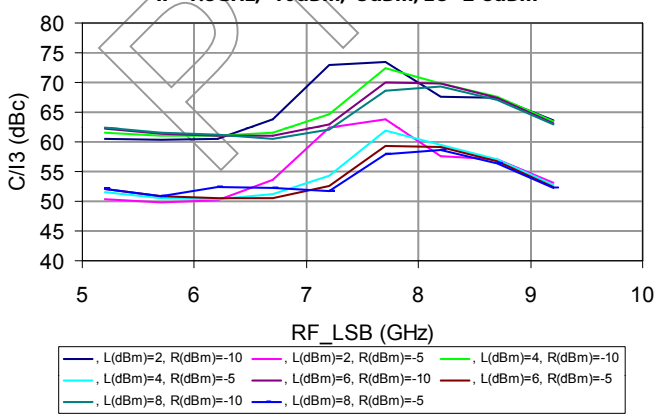
XU1012-QH: OIP3 (dBm) vs. RF_LSB (GHz)
IF=1.8GHz, -10dBm, -5dBm, LO=2-8dBm



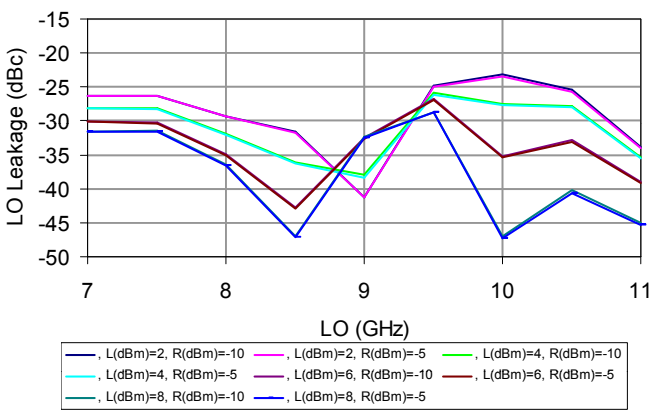
XU1012-QH: IIP3(dBm) vs. RF_LSB (GHz)
IF=1.8GHz, -10dBm, -5dBm, LO=2-8dBm



XU1012-QH: C/I3 (dBc) vs. RF_LSB (GHz)
IF=1.8GHz, -10dBm, -5dBm, LO=2-8dBm



XU1012-QH: LO Leakage (dBc) vs. LO (GHz)
IF=1.8GHz, -10dBm, -5dBm, LO=2-8dBm



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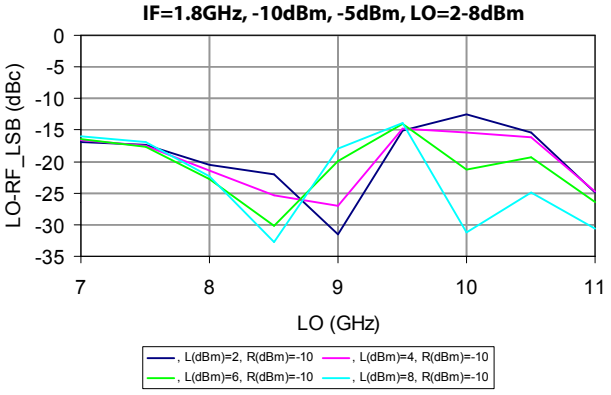
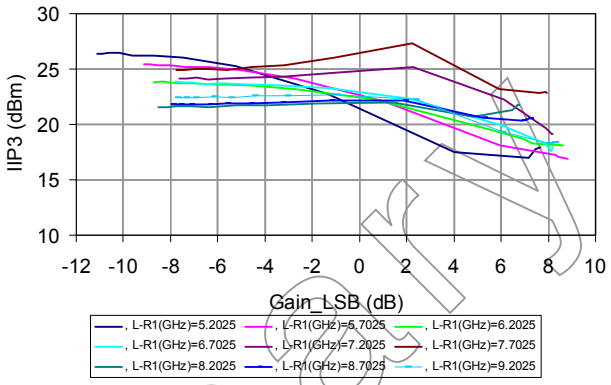
Measured Performance (cont.)

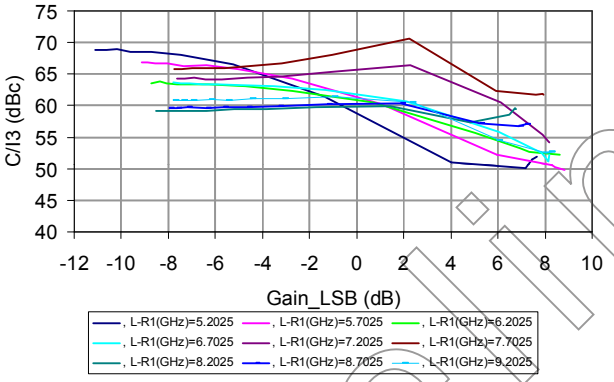
XU1012-QH: LO-RF_LSB (dBc) vs. LO (GHz)
IF=1.8GHz, -10dBm, -5dBm, LO=2-8dBm



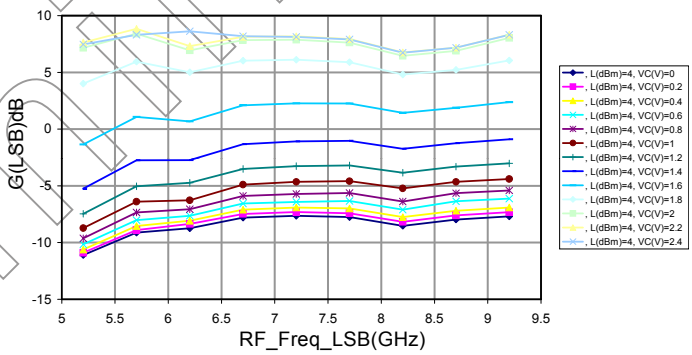
XU1012-QH: IIP3 (dBm) vs. Gain_LSB (dB)
Attenuator Vcontrol = 0 to -2.4V



XU1012-QH: C/I3 (dBc) vs. Gain_LSB (dB)
IF=-5dBm, Vcontrol = 0 to -2.4V



XU1012-QH EA QFN: G(LSB)dB vs. RF_Freq_LSB(GHz)
Integrated RF Variable Attenuator, Vcontrol=0 to -2.4V

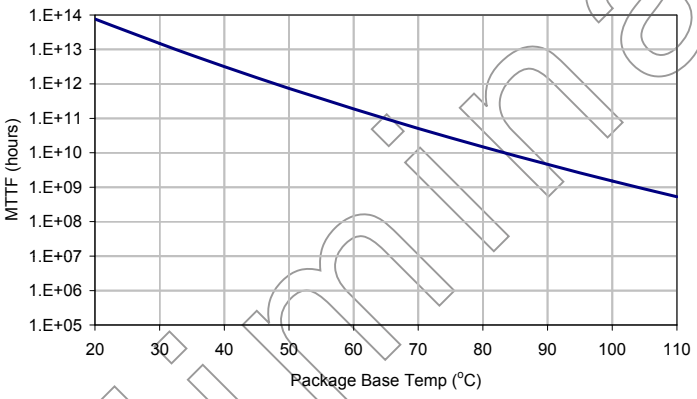


App Note [1] Biasing - As shown in the Pin Designations table, the device is operated by biasing Vd1, Vd2, and Vd3 at 5.0V. The corresponding drain currents are set to 80mA, 60mA and 20mA respectively. It is recommended to use active bias on Vg1, Vg2, Vg3 to keep the currents in Vd1, Vd2, and Vd3 constant in order to maintain the best performance over temperature. Depending on the supply voltages available and the power dissipation constraints, the bias circuits may include a single transistor or a low power operational amplifier, with a low value resistor in series with the drain supply to sense the current. Make sure to sequence the applied voltage to ensure negative gate bias is available before applying the positive drain supply.

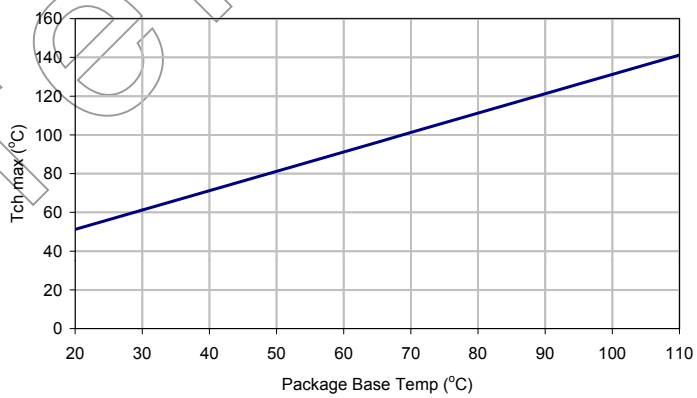
Variable gain is achieved by biasing Vc from -2.5V (max. gain) to 0.0V (min. gain).

MTTF Graphs

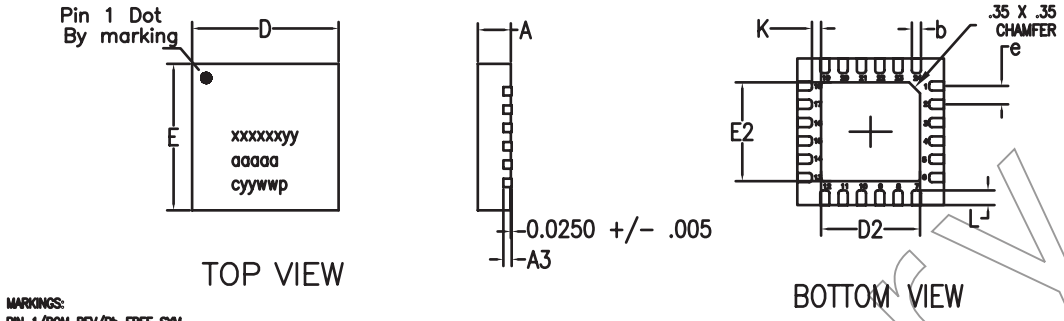
XU1012-QH-0G00: MTTF Hours vs. Package Base Temperature
Vd1,2,3=5V, Id1=80mA, Id2=60mA, Id3=20mA, Vc=-3V



XU1012-QH-0G00:Tch(max) vs. Package Base Temperature
Vd1,2,3=5V, Id1=80mA, Id2=60mA, Id3=20mA, Vc=-3V



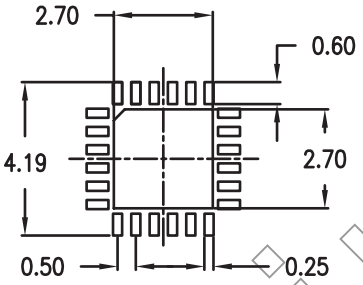
Package Dimensions / Layout



MARKINGS:
PIN 1/BOM REV/Pb FREE SYM
MIMIX PART/MODEL NO.
WAFER LOT NUMBER
DATE CODE

NOTES:
1. DIMENSIONS ARE IN MM.

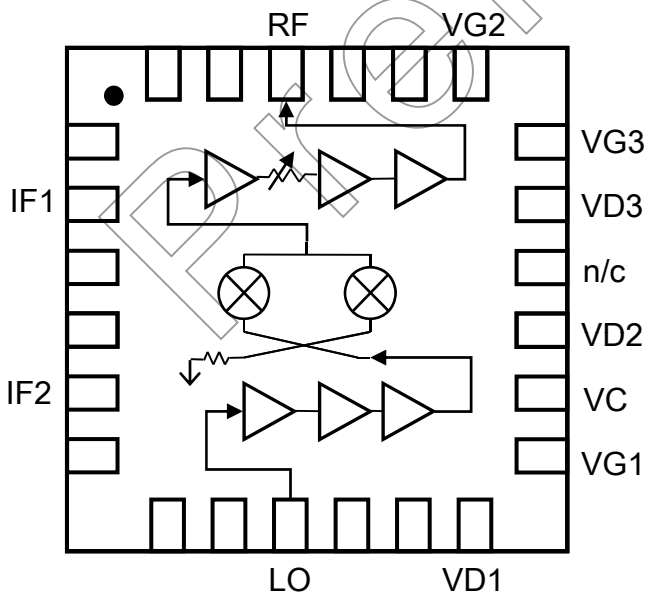
RECOMMENDED SOLDER PAD PITCH AND DIMENSIONS



	MIN	TYP	MAX
A	0.80	0.90	1.00
A3		0.20 REF	
b	0.20	0.25	0.30
K	0.20	–	–
D		4.00 BSC	
E		4.00 BSC	
e		0.50	
D2	2.45	2.60	2.75
E2	2.45	2.60	2.75
L	0.20	0.30	0.40

1. VIEWS ARE NOT TO SCALE: USE DIMENSIONS AND TABLE.

Functional Schematic



Pin Designations

Pin Number	Pin Name	Pin Function	Nominal Value
2	IF1	IF1 Input	
5	IF2	IF2 Input	
9	LO	LO Input	
12	VD1	Drain 1 Bias	5.0 V, 80 mA
13	VG1	Gate 1 Bias controls drain current in VD1	- 1 V
14	VC	Attenuator Control	- 2.5 V
15	VD2	Drain 2 Bias	5.0 V, 20 mA
17	VD3	Drain 3 Bias	5.0 V, 60 mA
18	VG3	Gate 3 Bias controls drain current in VD3	- 1 V
19	VG2	Gate 2 Bias controls drain current in VD2	- 1 V
22	RF	RF Output	

Handling and Assembly Information

CAUTION! - Mimix Broadband MMIC Products contain gallium arsenide (GaAs) which can be hazardous to the human body and the environment. For safety, observe the following procedures:

- Do not ingest.
- Do not alter the form of this product into a gas, powder, or liquid through burning, crushing, or chemical processing as these by-products are dangerous to the human body if inhaled, ingested, or swallowed.
- Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.

Electrostatic Sensitive Device - Observe all necessary precautions when handling.

Life Support Policy - Mimix Broadband's products are not authorized for use as critical components in life support devices or systems without the express written approval of the President and General Counsel of Mimix Broadband. As used herein: (1) Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user. (2) A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

Package Attachment - This packaged product from Mimix Broadband is provided as a rugged surface mount package compatible with high volume solder installation. Vacuum tools or other suitable pick and place equipment may be used to pick and place this part. Care should be taken to ensure that there are no voids or gaps in the solder connection so that good RF, DC and ground connections are maintained. Voids or gaps can eventually lead not only to RF performance degradation, but reduced reliability and life of the product due to thermal stress.

Typical Reflow Profiles

Reflow Profile	SnPb	Pb Free
Ramp Up Rate	3-4 °C/sec	3-4 °C/sec
Activation Time and Temperature	60-120 sec @ 140-160 °C	60-180 sec @ 170-200 °C
Time Above Melting Point	60-150 sec	60-150 sec
Max Peak Temperature	240 °C	265 °C
Time Within 5 °C of Peak	10-20 sec	10-20 sec
Ramp Down Rate	4-6 °C/sec	4-6 °C/sec

Mimix Lead-Free RoHS Compliant Program - Mimix has an active program in place to meet customer and governmental requirements for eliminating lead (Pb) and other environmentally hazardous materials from our products. All Mimix RoHS compliant components are form, fit and functional replacements for their non-RoHS equivalents. Lead plating of our RoHS compliant parts is 100% matte tin (Sn) over copper alloy and is backwards compatible with current standard SnPb low-temperature reflow processes as well as higher temperature (260°C reflow) "Pb Free" processes.

Part Number for Ordering	Description
XU1012-QH-0G00	Matte Tin plated RoHS compliant 4x4 24L QFN surface mount package in bulk quantity
XU1012-QH-0G0T	Matte Tin plated RoHS compliant 4x4 24L QFN surface mount package in tape and reel
XU1012-QH-EV1	XU1012-QH evaluation board

Caution: ESD Sensitive
Appropriate precautions in handling, packaging and testing devices must be observed.

Proper ESD procedures should be followed when handling this device.